US Army Corps of Engineers

Hydrologic Engineering Center

Second Quarter Activity Report

FY 1999

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Activity Report

Hydrologic Engineering Center **Second Quarter 1999**

Executive Summary

On-going projects and new projects are keeping us very busy. Activity was most intense on WCDS Version 1.0 deployment, readying/releasing new products under the NexGen project, bringing to close two major technical assistance projects (Sacramento - San Joaquin Comprehensive Study model development, and Panama Canal Expansion study model development), and continuing efforts in the upper Mississippi Basin flood frequency study. Late in the quarter, restoration of Savings and Slippage funded a new start of a Dam Safety research program. Staff remains stable, reimbursable projects continue to flow in, and model maintenance subscription fees are coming in, albeit slowly.

The Water Control Data System (WCDS) software modernization and integration project is now in the third year of an intensive five and one half year, five million dollar development effort. WCDS is the Corps decision support Automated Information Systems (AIS) that serves the Corps water management mission. Activity this past quarter focused on preparation for and initiation of WCDS Version 1.0 deployment. This is the first of two planned interim deployments prior to Version 3.0, which will complete the system that will be deployed in 2001/2002. A working session was held for the four deployment sites in which deployment teams began data system criteria preparations and model data assembly. This was followed by a Version 1.0 validation session, designed to test Version 1.0's readiness for deployment. Deployment began with HEC teams installing the data acquisition and data management software followed by installation and training in decision support modeling and use. By quarter's end, initial deployment activities had occurred in Baltimore and Huntington Districts. Early next quarter, deployment will be initiated in Omaha District and Northwest Region - Portland. Activities through the third quarter will focus on resolving problems that arose during deployment, solidifying the Version 1.0 software system, and holding post-deployment evaluation and Corps Users Review Group (CURG)/System Design and Test (SDT) team meetings. Corps offices can follow progress on the project via the Web: (http://cw71.cw-wc.usace.army.mil/cwcinfo/cwc.html)

The NexGen software research and development project continues at a brisk pace. The companion HEC-RAS Arc/Info GIS applications package that will provide cross section geometry from digital terrain models, and enable automated inundation mapping is nearing release - next quarter for sure. It is being applied in a major project that will help to solidify the remaining details. A bug fix and minor update for HEC-HMS (Version 1.1) was released and good progress continues for the planned summer release of Version 2.0 of HEC-HMS. This release will include a continuous moisture accounting loss algorithm, as well as other additions. Progress continues on the two NexGen software programs that are components of the WCDS. The real-time reservoir operations model (HEC-RSS), and a flood impact analysis model (HEC-FIA) are both components of the Version 1.0 WCDS software deployment discussed above. The HEC-FIA program is being applied in the Sacramento-San Joaquin Comprehensive Study. These programs will continue to be improved and will likely be released in stand-alone form within a year or so.

Activities related to risk-based analysis and flood frequency analysis continue for the areas discussed last quarter. HEC hosted the second meeting of the National Academy of Sciences National Research Council (NRC) in our offices in Davis, California, in February. NRC is studying Corps Risk-based analysis policies and applications. HEC made presentations to the panel, and has had follow-on information exchanges with panel members. We supported the Sacramento District (SPK) in their activities associated with another NRC panel examining

the American River/Folsom Dam, California, inflow frequency curve. The NRC report was released in early February. HEC assisted CESPK with review of the report and formulation of a Corps response. In the end, the Corps made use of some of the NRC recommendations but decided to stay with the methods contained in the current Federal Interagency Guidelines (Bulletin 17B). The re-study of flood frequency on the upper Mississippi River in light of the flood of 1993 is entering the final phase. A report documenting the flow-frequency analysis results is due out in September 1999. Activities this past quarter included briefing stakeholders on methodology and data compilation efforts, and continuing with detailed analysis.

The project to update the model geometry for the Mississippi Basin Model System (MBMS) for the upper Mississippi to reflect more recent mapping and to develop an inundation mapping component based on the new mapping moved into full production. The plan is to merge the several mapping sources into a digital DTM, cut spatially located cross sections from the DTM, and integrate the new data into re-calibrated UNET unsteady flow models. Automated inundation area mapping based on UNET forecasts will be made operational for selected areas. Contracts to merge the data sources and cut the cross sections were formulated and several awarded. All cross section contracts will be underway by the middle of next quarter. New digital cross section data will start flowing to the districts in the fourth quarter and be completed in the second quarter of FY 2000. The MBMS update is expected to be completed by mid- FY 2000.

We are near completion with the reimbursable project to assist in modeling the Sacramento and San Joaquin river basins for flood control operations. This is part of a comprehensive study by Sacramento District to review the flood damage reduction system for the Central Valley of California. Models under development (separate models for the Sacramento Valley and San Joaquin Valley) are: HEC-5 for flood control operations; HEC-FCLP, system flood control operation optimization; and HEC-FIA, flood economic/damage impact analysis model. Phase I models, now near completion, are being made operational for the recent 1995 and 1997 large flood events. Data compilation, and some of the model development will later serve as the base for modernized WCDS implementation for these areas. HEC may be involved in Phase II model improvements.

A re-emerging area is that of dam safety. The pilot effort involving risk-based analysis of the safety of Alamo Dam in southern Arizona is now completed. Also, a new dam safety R&D activity is now funded with FY 1999 Savings and Slippage R&D restoration funds. Funds were received at the end of the quarter. HEC will be investigating uncertainty in Probable Maximum Flood estimates, and frequency of extreme floods. These activities reflect a growing national/international interest in applying appropriate risk-based analysis methods to dam safety issues.

Darryl W. Davis, P.E.
Director

HYDROLOGIC ENGINEERING RESEARCH PROGRAM

Catchment Analysis System
Work Unit 32444

Version 1.1 of HEC-HMS was released in March 1999; it contains many bug fixes as well as enhanced communication between HEC-HMS components, a new installation system, improved time-interval selection, and more error reporting. Bug-tracking software has been very helpful to manage software improvement process and to provide information to users reporting problems and recommendations. The draft HEC-HMS Technical Reference Manual has undergone technical review and is being revised. After formal HEC review, the manual will be ready for distribution in the third quarter this FY. Several changes have also been made to HEC-HMS to facilitate its use in water control applications. The snow preprocessor is undergoing applications testing at CECRL and should be available for HEC applications next quarter.

Before continuing with Version 2.0 of HMS, the newly released Version 1.1 was recompiled and linked with updated releases of the Galaxy software development system as well as several of the support libraries. Several changes in the HEC-HMS code are being made in those software upgrades. Version 2.0 of HEC-HMS (expected release in the fourth quarter) with detailed soil moisture accounting is proceeding well; the engine and interface codes are finished and ready for testing as soon as the software upgrades are completed. Several other features (rating tables, meteorologic model, run configuration, global editing of kinematic wave transforms, and flow ratios) are also completed or under design. The testing of the use of Java for the graphics and GUI software is showing that this change is feasible. A draft report on wetlands' hydrologic processes was completed. (research 2nd/99)

River Analysis System
Work Unit 32443

This work unit will produce a uniform set of tools for use by hydraulic engineers in a workstation environment. The River Analysis System (HEC-RAS), Version 1.0 program was completed, the Hydraulic Reference and User's manuals were published, and the package started distribution in August 1995. The program is a Windows-based standard-step model that computes steady-flow profiles for subcritical, supercritical, or mixed flow regimes. During FY 1996, Version 1.1 and 1.2 were released to provide error corrections and an added program capability. In FY 1997, in-line weirs and spillways, channel modifications, links to 3D geometric data, and numerous program enhancements were completed. The Federal Highway bridge model and scour analysis were added with FHWA funding, and Version 2.0 plus three reference documents were distributed. In FY 1998, the components of an unsteady flow program were completed for processing cross sections, bridges, and culverts. Also, steady-flow Versions 2.1 and 2.2 were developed. During the first quarter of FY 1999, HEC-RAS Version 2.2 and new program documentation were completed and distributed. Development of the unsteady-flow capability continues. A beta version for testing is expected this FY. (training 2nd/99)

Resolving Water Allocation and Use Conflicts
Work Unit 32976

This R&D work unit features development and application of reservoir system optimization programs to assist in resolving water allocation and use conflicts that arise from changing conditions. The two primary programs are the Prescriptive Reservoir Model (HEC-PRM) and Flood Control Linear Program (HEC-FCLP). The research continues to push the state-of-the-art in operations research modeling for flood analysis by enabling more detailed representation of the system. A "mixed integer" method was implemented and successfully tested in flood studies for the Sacramento and San Joaquin reservoir systems. The approach enabled a better representation of the system reservoir outflow and weir operations (non convex penalty functions) and guarantees a global optimum result. Additional research this fiscal year will focus on implementing: an enhanced solver; formulation of a better solution matrix; capability of limiting the

foresight to better mimic operation capabilities; and testing of commercial "data mining" software to assist with interpretation of the output. The flood control funding for the Sacramento and San Joaquin systems was augmented by funds from HEC's technical assistance work on the Sacramento-San Joaguin Comprehensive Study.

Several improvements to the HEC-Prescriptive Reservoir Model (HEC-PRM) network flow program were completed during the second quarter. The research and development funds for these efforts were augmented by funding by UC Davis for modeling enhancements for the CalFed Study. A workshop was held at HEC for three Panamanians to provide technology transfer of the HEC-PRM analysis portion of the Panama Canal Capacity study.

Work continued at a modest pace on incorporation of the HEC-PRM and HEC-FCLP software into the HEC-Reservoir System Simulation (HEC-RSS) Package. The goal is to have a Beta version PRM and FCLP software fully operational with present capabilities completed by the end of this fiscal year. (planning 2nd/99)

Statistical Methods in Hydrology
Work Unit 32599

Continued analysis of the new missing-data estimation algorithm took place as well as evaluating methods to estimate flood frequency curves for rivers with reservoir regulation. Work on making the HEC statistics library (statLib) a part of the new HEC-DSS was delayed pending completion of the new HEC-DSS package. A coordination meeting with the Interagency Work Group on Flood Frequency was held to review results of the Upper Mississippi River System flood frequency study. (research 2nd/99)

Reservoir Analysis System
Work Unit 32602

The objective of this work unit is to develop a family of reservoir analysis tools to facilitate a broad range of investigations ranging from reconnaissance-level planning studies to detailed reservoir regulation plan investigations. These tools will complement the existing HEC-5 Simulation of Flood Control and Conservation Systems Program and the Prescriptive Reservoir Model, HEC-PRM. A requirements documentation for a new reservoir model was completed in FY 1995. During FY 1996, a basic reservoir GUI was developed to create model data and run computer programs HEC-5 and HEC-PRM. In FY 1997, the focus shifted to develop a prototype reservoir model for the water control data system (WCDS). A software design was developed to support the WCDS goals and to provide a next generation system model. During FY 1998, a prototype reservoir model was essentially completed. During the first quarter of FY 1999, the prototype program was completed and demonstrated for WCDS. Version 1.0 of the program was nearly completed during the second quarter and testing began. (training 2nd/99)

Terrain-Based H&H Modeling
Work Unit 32975

Hydrology. Good progress is being made on the development of terrain data analysis tools to support HEC-HMS hydrologic modeling of river basins. The work has two main components: 1) identification of watersheds and channels to facilitate the topological description of the river basin for HEC-HMS; and 2) estimation of HEC-HMS watershed parameters as well as general watershed/river characteristics pertinent to hydrologic modeling. Through the Cooperative Research and Development Agreement (CRADA) with the Environmental Systems Research Institute, ESRI, and contracts with the University of Texas' Center for Research in Water Resources, CRWR, initial terrain analysis tools for HEC-GeoHMS have been completed. Work is on track for a beta release early in the 4th quarter. (research 2nd/99)

Hydraulics. With the development of HEC-GeoRAS, the Hydrologic Engineering Center has linked ARC/INFO data development and display capabilities to HEC-RAS for performing hydraulic analysis. HEC-GeoRAS facilitates model development by allowing a hydraulic engineer with little GIS training to develop geometric data for import in HEC-RAS and view exported water surface profile results. HEC-GeoRAS Version 1.0 is currently scheduled for release during the third quarter FY 1999, including User's Manual documentation. Future versions of GeoRAS will include the capability

to extract land use data for estimation of roughness coefficients for import into HEC-RAS and visual display of velocities exported from HEC-RAS. (training 2nd/99)

Urban Hydrology Methods
Work Unit 32875

Hydrology. Several different models' capabilities for representation of urban hydraulic structures are being analyzed. The structures being considered are detention ponds, culverts, bridges, diversions, and pumps. The models being used are HEC-1, HEC-HMS, HEC-RAS, HEC-IFH, and UNET. Initial methodology and testing are being conducted both with the above models as well as independent solution of their equations. (research 2nd/99)

Hydraulics. This work unit will develop modeling features required for many urban studies. The requirements for unsteady flow applications in the urban environment have been reviewed and defined in conjunction with the review of a UNET application for the Sacramento District. The required features will be incorporated with the development of unsteady flow capability in HEC-RAS. During the second quarter of FY 1999, there was no activity due to work on higher priority work units. (training 2nd/ 99)

Flood Damage Analysis
Work Unit 32876

This work unit develops software for more efficient flood damage computations. The research efforts are coordinated closely with the Risk Analysis Work Unit 32896 and Geographic Information System Work Unit 365-A, Flood Damage Analysis Using GIS Technology. The initial public release Version 1.0 of the new HEC-FDA program and accompanying user's manual was made in January 1998. An updated version, Version 1.1, that fixes several minor computation bugs will be released during the third quarter. The conversion of the version 1.0 Galaxy user interface to Java continued during the quarter. It will be part of the Version 2.0 upgrade scheduled for release in the fall of 1999. (planning 2nd/99)

Internet for Planning
Work Unit 33050

This limited funded work unit targets ways to use the internet in planning studies. The focus this year is on its use in study management. The test application is the Tres Rios wetlands restoration study where HEC provided technical assistance in water balance analysis and used the internet as a ways of conveying study information and results to others. This work unit will be completed in FY 1999 with the intent on the use of the internet becoming a normal process within the framework of the study. (planning 2nd/99)

Analysis of Ground-Surface Water Interaction
Work Unit 32703

Most of the work this quarter involved coordination with our co-developer at the University of Nevada, Reno. The connection of the USGS MODFLOW model to HEC-HMS is proceeding well. (research 2nd/99)

Development of an Initial Data Warehouse for Coralville Reservoir Water Balance Analysis
Work Unit 33104

A data set summary report for the data warehouse at the Corps Coralville was received from the University of Iowa for the Comprehensive Flood Impact Response Modeling System (CFIRMS). Work continued on operational testing and installation of the data warehouse system at the Rock Island District in the last quarter of this FY. (research 2nd/99)

RISK ASSESSMENT RESEARCH PROGRAM

Risk-based Analysis for Flood Damage Reduction Studies Computer Program
Work Unit 32896

The Flood Damage Analysis (HEC-FDA) package, version 1.0, includes risk-based analysis methods for formulating and evaluating flood damage reduction measures. The work performed is coordinated closely with Hydrologic Engineering Work Unit 32876, Flood Damage Analysis. HEC-FDA operates in Windows 95, 98 and NT, and Sun Solaris UNIX-based operating systems. The package includes a modern GUI, enhanced project damage and performance calculations, and graphical outputs. Uncertainty algorithms for exceedance probability, stage, and damage are an integral part of the program. The program output is consistent with present Corps guidance of ER 1105-2-101, Risk-based Analysis for Evaluation of Hydrology/Hydraulics, Geotechnical Stability, and Economics in Flood Damage Reduction Studies and EM 1110-2-1619, Risk-based Analysis for Flood Damage Reduction Studies. Development efforts during FY 1999 are concentrating on: adding cost and uncertainty relationships; and, expanded rating function capabilities for conditions such as debris, bulking, and ice. These capabilities will be incorporated into Version 2.0, scheduled for release during the fall of 1999. (planning 2nd /99)

Hydrologic Risk & Uncertainty & Environmental Restoration Performance
Work Unit 33214

Riverine environmental restoration studies require the statistical uncertainty of low- and high- flow regimes affecting the design, maintenance and operation of the project over its life be quantified and included in the analysis. This new work unit will develop, document and deploy risk-based analysis procedures for hydrologic engineering analysis associated with riverine environmental restoration studies. Emphasis is on defining and developing uncertainty methods for hydrologic variables critical to riverine restoration investigations. A coordination meeting with the Environmental Lab (CEERD-EV), Institute for Water Resources (CEWRC-IWR), and HEC representatives was held at Ft. Belvoir to establish a general framework for the types of analyses required for environmental restoration studies. The immediate goal of this work unit effort is to develop a draft of a Hydrologic/Hydraulics Guide Manual for Riverine restoration studies by the end of the fiscal year. A joint seminar among the three offices on Riverine restoration studies is being planned for this fall. (planning 2nd /99)

GEOGRAPHIC INFORMATION SYSTEM RESEARCH PROGRAM

Flood Damage Analysis Using GIS Technology
Work Unit 363-A

This new work unit creates capabilities to perform flood damage assessments in a more integrated manner, reduce field survey time and effort, and provide easy to understand output and displays. The objective is to develop a new Structure Inventory and Analysis capability that is fully integrated with the HEC-FIA and HEC-FDA program to form the HEC Flood Damage Analysis Package. GIS capabilities for structure inventories, flood impact analysis and displays are the integral part of the program. The software will be integrated into the Flood Damage Analysis Package and coordinated with flood impact analysis software and procedures being developed under real-time water control activities. The research is focusing on: 1) alternative GIS methods for structure inventories; 2) computations by grid cells; 3) computations using aerial photograph images, digital elevations, and flood inundations; and 4) spatial output displays. Activities during the quarter were on development of the working prototype which is scheduled for completion during the third quarter of this fiscal year. (planning 2nd/99)

Integration of Models and Spatial Technologies
Work unit 33175

Several HEC models (HMS, RAS, FDA, FFA, HEC-5/5Q, and the WCDS) were input to the catalog of Corps capabilities. Another part of HEC's responsibility in this multi-Lab work unit was to provide a case study of connecting engineering software to commercial, off-the-shelf GIS systems. The HEC-GeoRAS ARCINFO pre- and post-processor for HEC-RAS was successfully demonstrated for that case study. As part of the hydrologic/hydraulic case study modeling effort, HEC will continue its work with the University of Texas and the Environmental Systems Research Institute to enhance GIS applications for HEC's HMS and RAS models. (research 2nd/99)

WATER CONTROL DATA SYSTEM MODERNIZATION

The significant tasks for FY 1999 are to deploy Version 1.0 in selected field offices, and continue development toward the final Version 3.0 - two years hence. Deployment of Version 1.0 will take place in Baltimore District, Huntington District, Omaha District, and Northwest Region - Portland. This is the first of two planned interim deployments prior to Version 3.0, which will complete the system, that will be deployed in 2001/2002. A working session was held for the four deployment sites in which deployment teams began data system criteria preparations, and model data assembly. This was followed by a Version 1.0 validation session, designed to test Version 1.0's readiness for deployment. Deployment began with System Developer (HEC) teams installing the data acquisition and data management software followed by installation and training in decision support modeling. By quarter's end, initial deployment activities had occurred in Baltimore and Huntington Districts. Early next quarter, deployment will be initiated in Omaha District and Northwest Region - Portland. Activities through the third quarter will focus on resolving problems that arose during deployment, solidifying the Version 1.0 software system, and holding post-deployment evaluation and Corps Users Review Group (CURG)/System Design and Test (SDT) team meetings. Corps offices can follow progress on the project via the Web at (http://cw71.cw-wc.usace.army.mil/cwcinfo/cwc.html) (executive 2nd/99)

Data Capture

The data capture program allows a GOES or AFOS data stream to be fed into the Water Control Data System where it will be decoded and posted to the Oracle database. The data capture capability is designed to collect data in a redundant fashion on two separate computers. Version 1.0 of the software was completed and deployed at two sites during the second quarter. (tech asst 2nd/99 AEM)

Data Decoding, Transformation and Validation

The GUI for GOES decoding criteria was completed and is being used at the deployment sites. Two utilities (sit & gencrit) were developed that allow for the automatic generation of criteria files directly from a sample of SHEF or GOES raw data that has been decoded from either programs shefit or goesit. This utilities allow for the very rapid creation of the shef process criteria files which can then be further refined by the SHEF or GOES GUI decoding criteria editor. Work continued on the inclusion of real-time mathematical and table lookup transformation of data as it is received to the shef process. (tech asst 2nd/99 AEM)

Data Base System

Oracle 8.0.5 RDBMS was selected on short notice to replace 8.0.4 for WCDS Version 1.0 deployment, because Oracle had fully validated 8.0.5 with a required upgrade to Solaris 7, which was required on short notice for security reasons on all Corps Solaris systems. For Version 1.0, an Oracle data model was developed and implemented to support three WCDS data objects; the time series object, location object, and catalog objects - which are essentially lists of stations or time series in the data base for use in GUI selection lists. Data Base backup procedures were developed for use with Version 1.0 system. The completion of database testing was delayed due to problems encountered during November and December. The same people involved in data base testing are working on Version 1.0, and the relative priority of Version 1.0 work required that completion of testing be scheduled after deployment. Deployment of the data base subsystem for Version 1.0 began in March and will continue into be beginning of next quarter. (tech asst 2nd/99 DJB)

Data Dissemination

Data Dissemination activities during the Second Quarter of FY1999 focused on making preparations for deployment of WCDS software at four Corps locations. At each of the deployment sites, a series of Web pages depicting various aspects of the WCDS data collection and modeling process will be provided. It is intended that each of the

deployment sites will adapt the example pages to data sources and watersheds that are applicable to their local implementation.

The initial set of Web pages include a set of seven example Web pages, a selection page, and a home page which allows the Web user to choose the watershed of interest. The Web pages show different aspects of the WCDS system including status of the Data Acquisition system, status of the latest data received and posted to the database and a summary of the current conditions. In addition to providing example information, the Web pages were also designed to demonstrate methods which can be used to produce graphical plots and images as well as tables to display pertinent information. (tech asst 2nd/99 CWF)

Data Archiving

Archiving is required to provide data for mission performance accountability, to enable Corps offices to disseminate and/or exchange data, and to provide a consistent data file system suitable as legal documentation. Automated means will be provided for periodic archiving and as needed purging of information from the WCDS data base. Means will also be provided for automated retrieval from the data archive and placement into the WCDS data base or standard dissemination files. Data Archiving was included in the requirements and software design process being overseen by the Data Base SDT Team. Data archiving, was not included in the WCDS Version 1.0 software suite. Significant work on this issue is planned for later in this year. (tech asst 2nd/99 DJB)

Flow Forecasting and Forecast Evaluation

The GageInterp software was improved and documented for applications in the version 1.0 deployment. Applications assistance was also provided for use of the new Meteorological Forecast Processor (MFP) and the Hydrologic Forecast Processor (HFP) in the deployment. (research 2nd/99)

Reservoir System Simulation

Starting in FY 1997, requirements for real-time reservoir simulation were completed, a planning budget was developed, and priorities were set to fit the initial budget. Then a conceptual design document was developed to define program operation and a prototype plan was developed for initial program development. During FY 1998, the prototype reservoir program and pilot project data were completed. During the second quarter of FY 1999, deployment started with the Baltimore and Huntington Districts. Model testing continues with those offices. Version 1.0 modifications are nearly complete and the software will be updated at the deployment sites. (training 2nd/99)

River Hydraulics and Stage Forecasting

This element started in FY 1997. During the first half year, program requirements for river-stage forecasting were developed, reviewed, and completed; and a planning budget was developed. During the second half, a conceptual design document was developed and plans for a prototype program were completed. In FY 1998 a real-time interface for HEC-RAS for the WCDS was completed and integrated into the software system. During the second quarter of FY 1999 the interface update was completed to meet Version 2.2 capability. The software was included in the WCDS deployment to Baltimore and Huntington Districts. (training 2nd/99)

Flood Impact Analysis

The Flood Impact Analysis (HEC-FIA) computer program development continues with debugging and testing performed during the quarter. Some adjustments were also required for UNIX operations. The program is being applied to the Baltimore, Huntington, Omaha, and Portland districts WCDS deployment sites. HEC is working with the RS/GIS Center at CECRL, who is responsible for implementing the GIS flood impact analysis products for water control applications. The HEC-FIA program was designed and tested under the general direction of the water control flood impact analysis design team consisting of Corps field offices, CECRL, and HEC representatives. The goal is to have a fully integrated product with the WCDS CAVI and related software by the end of the calendar year 1999. (planning 2nd/99)

System Integration, Implementation, and Management

Several activities related to the administration of the WCDS modernized project continued during the Second Quarter of FY1999. Quarterly progress charts have continued to be used to monitor the progress of the development and deployment of Version 1.0 of the new WCDS software. The charts help focus attention on different aspects of the project, allowing resources to be moved or allocated in order to keep the project on track with proposed budgets and schedules.

Another activity which continued during the Second Quarter has been the continued use of weekly pre-deployment conference calls to coordinate activities at the various deployment sites and the WCDS developers. The phone conferences are typically held on Wednesday mornings each week and focus on reports from each of the developer team members and each of the deployment sites. This forum has been particularly useful in allowing discussions about different aspects of the WCDS software and to disseminate information about up-coming deployment activities. These calls will continue throughout the deployment activity.

In preparation for deployment activities later this spring, a pre-deployment working session was held in January 1999 at HEC. All of the participants were either staff from deployment sites or developers of the modernized WCDS software. At the session, presentations were made describing each of the WCDS components and pre-deployment activities which needed to be accomplished were described. Representatives from each of the deployment sites are currently busy implementing these pre-deployment tasks.

Refinements to the WCDS software structure have also continued. In addition to alterations to the WCDS directory structure, properties files containing WCDS system variables have been implemented. The properties files are used by each of the software components to establish items like network addresses, port numbers, number of process threads, etc. When fully implemented the properties files will exist in the same directory and specify all of the WCDS system parameters. (tech asst 2nd/99 AFP)

Application of GIS and Image Technology

GIS programs for calculation of inundated areas during forecasting have been integrated with the WCDS modeling suite and the CAVI. CorpsView data environments and controls have been reconciled with the CAVI and the WCDS file system. Inundation mapping programs are being installed at the test sites. CorpsView installations will be preformed separately. (research 2nd/99)

Control and Visualization Interface

Version 1.0 of the CAVI was used at the deployment working session given at HEC. The program was well received. The client side was run on a PC running MS Windows NT (4.0) and the server was run on the Sun Sparc. Some modest modifications that are planned before deployment to the field include changes to the forecast run alternative naming conventions, and specifying parameters (HEC-DSS “C” parts) for individual nodes when generating plots and tabulations.

Deployment was begun on Version 1.0 of the CAVI at the four deployment offices. The work has been primarily “clean up type,” with changes made for situations that were discovered in field deployment, and suggestions of the deployment testers. (tech asst 2nd/99 WJC)

Field Application Assistance

Assistance to the field continued during the Second Quarter of FY1999. Due to implementation of security measures in the Corps of Engineers, the WCDS software will now be deployed to Sun workstations using the Solaris 7 operating system. In preparation for this, HEC has recompiled all of its existing software for this operating environment. At this time, all of HEC’s existing software is available for Solaris 2.5.1 (hec61), Solaris 2.6 (hec62) and Solaris 7 (hec63). All of the Corps Water Control sites which upgrade their operating systems should get new copies of executables and libraries from the appropriate workstation at HEC.

Field Application Assistance also continued with several existing WCDS programs. In

preparation for modeling using the HEC-HMS program, help was provided in application and use of the “gridparm” and “gridLoadXMRG” programs. Both of these programs can be used to provide spatially distributed precipitation data as input to the HEC-HMS program. Several of the WCDS deployment sites plan to use spatial precipitation as part of the WCDS effort.

As part of the WCDS deployment effort, assistance is also being provided in use and administration of the Oracle database system. Some of the topics which are being addressed during the deployment phase of the modernized software include Oracle database backup and recovery, backups and archiving, and third-party software support. In addition to these topics, general ad-hoc support for Oracle has been, and will be available. (tech asst 2nd/99 CWF)

NUMERICAL MODEL MAINTENANCE AND SUPPORT

Numerical Model Maintenance for the family of HEC software consists of bug fixes and minor updates, hardware/software platform support, documentation updates and hot-line technical support. Corps offices that subscribe for these fee services will receive full support including: new software releases; interim updates and bug fixes; user's manuals and supporting documentation; short-duration technical consulting; and hot-line technical assistance via E-mail, fax, and telephone. Corps offices that do not subscribe are limited to the same courtesy afforded to other federal agencies: referral to HEC Web page and the National Technical Information Service (NTIS) for major software release versions; HEC Web page and NTIS for documents; and response to official correspondence regarding potential program errors and bugs. Subscription fees for FY 1999 total just over $500,000. Subscription fees continue to arrive - still short about half at this mid-year point. The primary software within each numerical model area together with the number of requests for assistance over the previous one year period, are shown below. A discussion of significant activities in each of the modeling areas follows the table. (executive 2nd/99)

Numerical Model Area	Primary Software	Latest four quarters Calls for assistance				
		3rd Quarter FY 98	4th Quarter FY 98	1st Quarter FY 99	2nd Quarter FY 99	Totals
Hydrologic Analysis	HEC-1, HMR52, HEC-HMS	32	37	74	61	204
River Analysis Systems	HEC-RAS, HEC-2, UNET, HEC-6	62	52	33	38	185
Flood Damage Analysis	FDA	58	63	41	47	209
Hydrologic Statistics	HEC-FFA, STATS	10	12	2	17	41
Reservoir System Analysis	HEC-5, HEC-5Q, HEC-PRM	20	17	10	4	51
Data Storage System	HEC-DSS	16	32	4	23	75
Interior Flood Hydrology	HEC-IFH	8	11	7	5	31
TOTALS		206	224	171	195	796

Hydrologic Analysis (HEC-1, HMR52, HEC-HMS)

Maintenance this quarter continued to concentrate on user support and bug fixes for HMS; Version 1.1 was completed and released. Software for tracking program problems, suggestions, and bug fixes is proving to be very helpful. An internal test of the HEC-HMS support Web-site was implemented to provide users up-to-date information on program problems and development activities. The Web-site will be made public next quarter. Other support was provided for HEC-1, HMR52, urban H&H models; and the groundwater model MODFLOW. (research 2nd/99)

Flood Frequency Analysis (HEC-FFA, STATS)

Program support was provided to district offices for program FFA, STATS and REGFRQ. Some further follow-ups to the UNIX version of FFA and REGFRQ were also made. (research 2nd/99)

Interior Flood Hydrology (HEC-IFH)

Version 2.0 of the computer program, "Interior Flood Hydrology" (HEC-IFH) was released for general use in January. Version 2.0 of the program includes some enhancements, numerous error corrections, and a revised user's manual. The main program changes include: (1) ability to run under the Windows NT;

(2) pump analysis results are now saved with the plan results; (3) input file date stamps are checked to preserve consistency between input and analysis results; (4) pond routing calculations have been refined; and (5) increased precision has been added. Technical support and assistance for the HEC-IFH program will continue, but no additional modifications will be made to the program. It is planned that interior area analysis capabilities will become part of a future version of the Hydrologic Modeling System (HEC-HMS) program. (research 2nd/99)

***Flood Damage Analysis** (HEC-FDA)*

Consultations with Corps offices using risk-based analysis methods remain at a high rate. Enhancements and corrections to the HEC-FDA program and its database processing procedures were made during the quarter. Work on fixing minor bugs in the program for the Version 1.1 program release continued during the quarter. (planning 2nd/99)

***River Analysis Systems** (HEC-RAS, HEC-2, UNET, HEC-6)*

Application assistance and one-stop phone assistance continues for HEC-2, HEC-6, UNET, and HEC-RAS. Version 2.2 of HEC-RAS was distributed with new program documentation. UNET has continued to be the focus of error corrections. (training 2nd/99)

***Reservoir System Analysis** (HEC-5, HEC, 5Q-HEC-PRM)*

General maintenance and field support activities for the HEC-5 family of programs continue. Program updates and modifications for complex system operation goals continued. During the second quarter, the HEC-5 Version 8.0 and program documentation were distributed. (training 2nd/99)

***Data Storage System** (HEC-DSS)*

Support and Data Management activities for the second quarter were primarily centered around providing telephone support and routine maintenance for the various data management tools. Most of the support centered around the primary HEC-DSS management tools, such as SHFDSS, DSSSHF, DWINDO, DSSUTL, DSPLAY , REPGEN, and DSSMATH. Work continued to make SHFDSS 'Y2K' compliant by the end of June. (tech asst 2nd/99 AEM)

Technical Assistance and Special Projects

Technical Assistance Projects are reimbursable projects performed for HQUSACE, Corps district and division offices, research laboratories, other federal agencies, and local governments. The scope of each project is negotiated on a case-by-case basis, including the full range from technical advisory services, review and oversight of studies by others, to performance of all aspects of investigations. Arrangements are made such that contracting associated with technical assistance projects is credited to the sponsoring office's contracting-out percentage. New projects begun this quarter include: HEC-5 Model Pee Dee River; Santa Ana River - HEC-RAS model using DTM data for geometry and ArcInfo HEC-GeoRAS as tool; HEC-RAS Computation utility for HEC-RAS geometry in UNET; review of National Research Council (NRC) American River Flood Frequency report; and investigation of potential linkage between the ERDC's proposed Land Management System (LMS) and the Water Control Data System (WCDS). Remaining projects are multi-year from FY 1998. (executive 2nd/99)

HQUSACE

CECW-EH

Mississippi Basin Model System Model Update **$960,000**

HEC is managing the project that is updating the model geometry for the Mississippi Basin Model System (MBMS) for the upper Mississippi to reflect more recent mapping and to develop an inundation mapping component based on the new mapping. The project moved into full production. The plan is to merge the several mapping sources into a digital terrain model (DTM), cut spatially located cross sections from the DTM, and integrate the new data into re-calibrated UNET models. Automated inundation area mapping based on UNET forecasts will be made operational for selected areas. Contracts to merge the data sources and cut the cross sections were formulated and several were awarded. All cross section contracts will be underway by mid to next quarter. Location of cross sections, electronic bathymetry, and integration of the new geometry into the existing models is being accomplished by the St. Louis, Rock Island, St. Paul, Kansas City and Omaha Districts. Mapping contracts for DTM development and geometry extraction are being managed by the St. Louis District. New digital cross section data will start flowing to the districts in the fourth quarter and be completed in the second quarter of FY 2000. The MBMS update is expected to be completed in FY 2000. (executive 2nd/99 P99-004)

Residual Flood Risk **$ 50,000**

HEC is developing procedures and capabilities to define and better communicate the residual flood risk associated with project conditions. This includes addressing residual risk for various flood conditions, project types (levees, channels, detention storage, nonstructural measures) and physical settings (population at risk, egress, damage potential) consistent with requirements of ER 1105-2-100, ER 1105-2-101, and EM 1110-2-1619. Within this framework, the analytical procedures and capabilities to better depict and communicate residual risk for formulating and evaluating flood damage reduction plans will be derived. Included are methods using risk and uncertainty to develop project performance and site information. The methods will ultimately be incorporated into the HEC-FDA computer program and distributed to Corps offices via brochures, videos, and CD's. Research was completed for a briefing document assessing the applicability of dam-safety methods to flood damage reduction project residual risk analysis and communication requirements. (planning 2nd/99)

Hydrology Committee **$22,500**

HEC is assisting CECW-EH with conducting this year's Corps Hydrology Committee meeting. Committee members were asked for potential discussion items. Most of these funds are for committee members travel. (research 2nd 99/P99-009)

GAGE Computer Upgrade **$19,883**

The gage Oracle/Web application software was successfully used in the previous Corps-wide data update cycle. Work is now deferred pending compilation of comments and improvement needs resulting from field experience. A prioritized list of improvements will be worked on, beginning later in the year, as funds permit. (tech asst 2nd/99 P98-093)

CECW-PF

FPMS Support **$30,000**

HEC is preparing a technical paper on the application of new GIS procedures to develop input to HEC-RAS and to display output as floodplain mapping. The paper will be presented at the annual Association of State Floodplain Managers Conference in Portland, Oregon, at the end of May. (training 2nd/99 P99-005)

Water Resources Support Center

Institute for Water Resources

Incorporating Cost Uncertainty into HEC-FDA **$25,000**

HEC is working with the Institute for Water Resources (IWR) on implementing cost and uncertainty analysis into the HEC-Flood Damage Analysis (HEC-FDA) version 2.0 program scheduled for release in the fall of 1999. The cost and existing program damage reduced analyses with uncertainty will enable net benefit analysis with uncertainty to be computed in the program. The design will be completed during the third quarter. The IWR is funding the work from a separate work unit of the Risk R&D program. (planning 2nd/99 P99-013)

Cold Regions Lab

Snow Modeling using Remotely Sensed Data **$10,000**

Work on this project is still delayed waiting for the snow model to be completed by CECRL. The Kings River Basin is being used to test the new snow model including snow cover mapping methods. The HEC-HMS model of the Kings River Basin underwent some improvements in preparation for the snow data. (research 2nd/99 P98-044)

Great Lakes and Ohio River Division

Detroit District

HEC-HMS Workshop's **$35,000**

The District has secured Corps Assistance- to-States funds for two workshops on the HEC Hydrologic Modeling System, HEC-HMS. The workshops will be provided in Indianapolis, Indiana, and Madison, Wiconsin, this summer. (research 2nd/99 T99-023&24)

HEC-RAS Workshop in Michigan **$17,500**

HEC will provide an HEC-RAS workshop to State representatives during 11 through 14 May. During the second quarter, class materials were prepared for reproduction and course arrangements were initiated. (training 2nd/99 T99-022)

Pittsburgh District

Coal Mining Hydrologic Impacts **$16,000**

Assistance continues to be provided for hydrologic analysis of impacts of coal-mine-land restoration. Reviews of appropriate modeling techniques and District plans were provided. (research 2nd/99 P99-001)

Mississippi Valley Division

Mississippi Basin Model **$60,000**

HEC is assisting with the application of new geometric data for the update of the MS UNET model. Model testing and comparison with old and new data was completed, using the data analysis performed by the St. Louis District. A draft report was prepared and is under review. (training 2nd/99 P98-075)

Rock Island District

Upper Mississippi River **$100,000**

The previous analyses of annual peak unimpaired flow frequency curves were updated and expanded for review by the project Technical Advisory Group next quarter. Also HEC continued its interaction with the Citizens' Advisory Group; a presentation about flood frequency analysis and application of those methods to the Upper Mississippi River System was prepared for the task force meeting next quarter. A report recommending methods for the flood frequency analysis was also completed (in draft) for the task force pending review by the Technical Advisory Group next quarter. (research 2nd/99 P99-003)

Vicksburg District

Survey Data for HEC-RAS **$5,000**

HEC developed a data conversion program for Vicksburg District to covert survey data into a format that can be directly input to HEC-RAS. The program was completed and provided to the District during the second quarter. (training 2nd/99 P99-011)

Northwestern Division

WCDS Oracle Performance Test **$20,000**

This project is funding set up, execution, and reporting on testing the performance of the WCDS Oracle data base software. The test plan has been developed, data identified for loading, and initial efforts started on testing. Oracle and DBI software problems slowed activities, with testing now planned for completion in the third quarter after deployment of Version 1.0 software. (tech asst 2nd/99 AFP P98-089)

Seattle District

Flood Forecasting **$19,455**

A draft report on flood forecasting downstream of the Howard Hanson and Mud Mountain dams was completed and reviewed. The final report will be submitted to the District next quarter. (research 2nd/99 P98-008)

South Atlantic Division

Charleston District

HEC-5 Model **$14,000**

HEC is providing assistance to the Charleston District developing an HEC-5 reservoir model for the Pee Dee River. During the first quarter, data assembly began and a framework HEC-5 data set was developed. During the second quarter, the HEC-5 model was completed. A tech-transfer meeting is planned for April. (training 2nd/99 P99-007)

Mobile District

Panama Canal Base Model **$149,420**

HEC is assisting the Panama Canal Commission (PCC) with an analysis of surface water availability for canal expansion. During FY 1998, HEC developed flow data for modeling and developed an HEC-5 and preliminary HEC-PRM reservoir system models for the existing system. During the first quarter of FY 1999, HEC presented an HEC-DSS workshop on the DSS programs used for data processing and an HEC-5 modeling workshop to the PCC staff. Reservoir model development for existing conditions was completed during the second quarter and an HEC-PRM workshop was presented to PCC staff during March. (training 2nd/99 P98-073)

Choctawhatchee-Pea River **$10,000**

Training of District and local staff will be provided as planned. Additional work on the Choctawhatchee-Pea River flood forecasting system improved the flow forecasting and river hydraulics models for the lower part of the basin. (research 2nd/99 P98-082)

South Pacific Division

Los Angeles District

Santa Ana River **$65,750**

HEC is developing an HEC-RAS model of the upper Santa Ana River. This will be a demonstration project using GIS data, and the new procedures, developed under the GIS work unit, to develop model data and to present model results. A tech-transfer workshop is planned to present the procedures used and the study report will likely be published as an HEC Project Report. The project just started during the first quarter of FY 1999 and basic data are still being assembled. During the second quarter, a field review of the project was conducted and study plans were developed. (training 2nd/99 P99-008)

HEC-RAS Split Modification **$40,000**

HEC is developing a split-flow option and a divided-flow analysis routine for the HEC-RAS computer program. These features were required by the Los Angeles District for the conduct of flood-reduction studies. During the end of FY 1998 and the first quarter of FY 1999, the new program features were developed and tested. During the second quarter, the added program documentation was completed and a test version was provided to the District. District review comments were provided and addressed; the project is complete. (training 2nd/99 P98-092)

Alamo Dam Safety Risk Analysis **$35,000**

Additional support was provided to the District and the Corps study team for dam-break simulations using the National Weather Service's DAMBRK program. The Alamo Dam dam outflows were routed down the Bill Williams River, into Lake Havasu, and then down the Colorado River to Mexico. Several telephone conferences were held with the District and the Corps' contractor in preparation of materials for a project briefing. The team briefed HQUSACE and others on the study results. HEC's part in the project was completed. (research 2nd/99 P98-087)

LAPRE-1 Capabilities for HEC-HMS **$19,000**

Work began by reviewing dimensionless unit graph and design storm capabilities requested by the District. A second coordination meeting was held with the District and Orange County. The AttKin routing method was reviewed for possible inclusion in HEC-HMS; the review showed it did not offer any improvements over the Muskingum-Cunge method already in HEC-HMS. Preliminary designs of the requested unit graph methods were made. (research 2nd/99 P98-094)

Sacramento District

Phase I Sacramento and San Joaquin River Basins Comprehensive Study **$385,000**

HEC is assisting the Sacramento District in its Phase I Sacramento and San Joaquin River Basins Comprehensive Study by developing Phase I level flood damage and reservoir system models of the two basins. The Phase I effort will evaluate the 1995 and 1997 flood events. Work during the quarter concentrated on completing and documenting the modeling efforts. Separate HEC-5, HEC-FCLP, and HEC-FIA models were developed for the Sacramento and San Joaquin reservoir systems.

Reservoir System Modeling. Two types of reservoir system analyses were performed: simulation modeling using the HEC-5 computer program; and optimization analysis of water allocation of the systems using the HEC Flood Control Linear Program (HEC-FCLP). The Phase I objective was to develop functional system models for the Sacramento and San Joaquin systems for the 1995 and 1997 floods. A report was prepared and sent to the Sacramento District documenting the study.

Food Impact Analysis. HEC-Flood Impact Analysis (HEC-FIA) models for the Sacramento and San Joaquin basins were completed during the quarter. The Phase I models were calibrated to the 1995 and 1997 observed event data. Information on the 87 impact area stage-urban damage, stage-number of structures, and stage-population functions, as well as, crop distribution patterns were provided by the Sacramento district and included in the models. The HEC-FIA model will enable planning and real-time event assessments of flood impact of the Sacramento and San Joaquin systems. (planning 2nd/99)

National Research Council Frequency Flow Analysis Report **$10,000**

HEC provided support to the District and the National Research Council, NRC, in their review of the American River Flood Frequency Analysis report prepared by the District. Several additional studies were performed to answer NRC panel questions. (research 2nd/99 P99-010)

HEC-RAS Comp Study **$6,000**

HEC developed a new program to translate HEC-RAS geometric data and output the data in UNET input format. The program and documentation were completed during the first quarter of FY1999 and submitted to the Sacramento District. The new program is provided with the Version 2.2 of HEC-RAS. (training 2nd/99 P99-002)

Tooele Army Depot Groundwater **$15,000**

Tooele groundwater modeling results briefings were provided to the District and the Utah team. The annual report was completed for Utah EPA. HEC's current responsibilities are complete; further studies are expected to begin next quarter. (research 2nd/99 P99-006)

Other Agencies

Metropolitan Water District of Southern California

Upgrade of HEC-DSS **$48,000**

The Metropolitan Water District of Southern California, the California Department of Water Resources, and HEC are combining resources to develop a new Graphical User Interface (GUI) for the HEC-DSS package. This tool will provide greater graphing and data manipulation capability of data in a HEC-DSS data base. The tool is being developed in the Java programming language, and will run under most operating systems including UNIX, Windows 95 and Windows NT.

A "map-based" interface has been developed which can act in a client-server mode, if desired. The map GUI is being developed in conjunction with the Water Control Modernization "CAVI" Project (so we have additional resources to work on the same software). The GUI reads in a map configuration file that can be produced from several sources, such as a GIS. The map has several tool items, like zoom, pan, etc. A user will select the data parameter and version from a box on the right side of the map, then select a location to either plot, tabulate, etc., the data.

This project is closely coordinated with the WCDS modernization project. Work will be re-initiated subsequent to completion of deployment of Version 1.0 and associated validation efforts. (tech asst 2nd/99 WJC P97-105)

TECHNOLOGY TRANSFER

No PROSPECT courses were presented during the second quarter, as shown in Table 1.

Other Training Activities

Three workshops were presented during the second quarter, as shown in Table 2. HEC provided an HEC-HMS workshop to engineers in the Omaha District and Missouri Regional Office. A Nonstructural Flood Damage Analysis workshop was sponsored by Floodplain Management for Nonstructural Committee members. Additionally, an HEC-PRM workshop was presented to the Panama Canal Commission staff as part of the Canal Capacity Study, described under Technical Assistance Projects.

Table 1. HEC FY 1999 PROSPECT TRAINING SCHEDULE

Course Title	Date	Length (weeks)	Number Students
Basic HEC-RAS	26 - 30 Oct 1998	1	24
Risk-based Analysis	16 - 20 Nov 1998	1	15
GIS - Hydrologic Engr	12 - 16 Apr 1999	1	
Basic HEC-HMS	17 - 21 May 1999	1	
Water and Watershed	12 - 16 Jul 1999	1	
Groundwater Hydrology	16 - 20 Aug 1999	1	
	TOTALS:	6	39

Table 2. HEC FY 1999 WORKSHOPS

Title	Sponsor	Date	Length (days)	No. of Students
HEC-DSS Workshop	Panama Canal	17 - 20 Nov 1998	4.0	7
HEC-HMS Workshop	FEMA	30 Nov - 4 Dec 1998	4.5	30
HEC-5 Workshop	Panama Canal	1 - 4 Dec 1998	4.0	8
HEC-HMS Workshop	CENWO	12 - 15 Jan 1999	3.5	24
Flood Damage Analysis	CECW-PM	9 - 11 Mar 1999	3.0	15
HEC-PRM Workshop	Panama Canal	17 - 19 March 1999	3.0	5
		TOTALS:	22	89